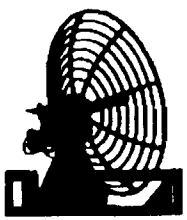
THE ACTS PROPAGATION TERMINAL DELIVERY AND SUPPORT

Warren Stutzman

Virginia Polytechnic Institute & State University
Bradley Department of Electrical Engineering
Satellite Communications Group
Blacksburg, Virginia 24061-0111

ACTS MINI-WORKSHOP
PASADENA, CA

June 14, 1993



VIRGINIA TECH
Satellite
Communications
Group

aptdel.drw
05/17/93

OUTLINE

- APT Program Overview
- Terminal Overview
- Physical units
- Test results
- Status of terminals and schedule
- Shipping cartons
- Site Support

a:outline.drw
06/09/93

ACTS PROPAGATION TERMINAL (APT) DEVELOPMENT PROGRAM OVERVIEW

OLYMPUS Measurement Campaign
- 12, 20, 30 GHz beacons
- Tested shared beacon receiver/total power radiometer design
- Determined that 1 Hz sample rate is sufficient
- Developed data collection software

Goals for APT
- Developed by user community

APT Prototype (1991-92)
- PDR: May 30, 1991
- CDR: July 7, 1992
- System tests with Olympus and ACTS: Summer 1992

APT Production (March 1992 - June 1993)
- Produce 7 terminals for experimenters
- Maintain prototype
- ACTSVIEW software
- Preprocessing software

Experiment Support (July 1993 -)

APT CHARACTERISTICS

ACTS Spacecraft Beacons

Frequency

Primary	20.185 GHz (V)	27.505 GHz (V)
Backup	20.195 GHz (H)	27.505 GHz (V)

Antenna

1.22 m offset HP: 0.85° @ 20.2 GHz 0.61° @ 27.5 GHz

Beacon Receivers

RF: Direct downconversion to 70 MHz

IF: 5 MHz intermediate, 455 kHz output

Sampling: 606 kHz (303 I, Q) at 455 kHz

DRX: Acquisition

Bandwidth: 180 kHz

Algorithm: 6 - 32k FFTs

Time to acquire: 3 s in fades up to 25 dB

Tracking

Bandwidth: 10 kHz

Algorithm: FFT and filtering to determine frequency and power

Lock: 31 dB fade

Radiometers

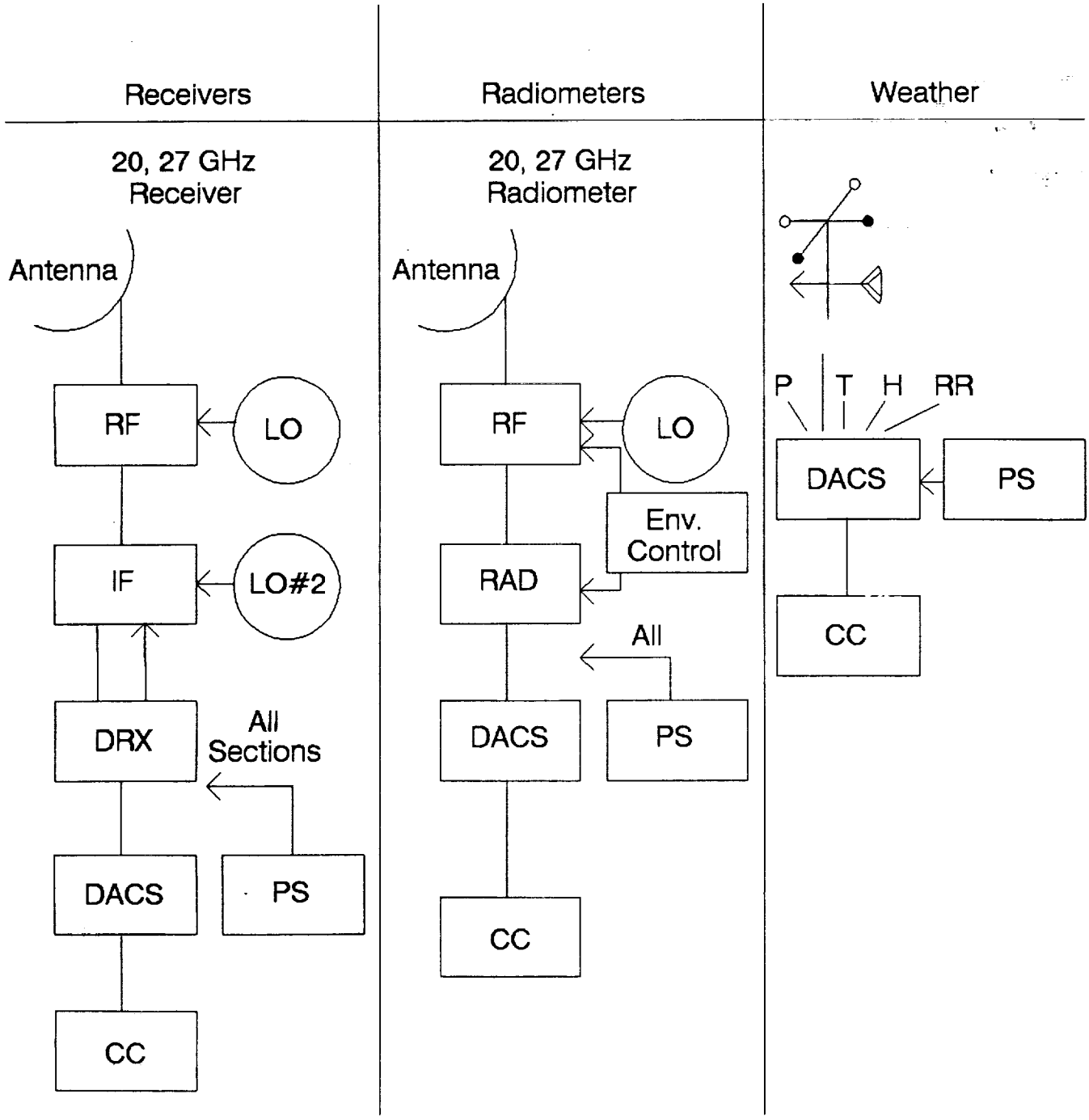
Input: 70 MHz from RF

Type: Total power

Detection bandwidth: 50 MHz

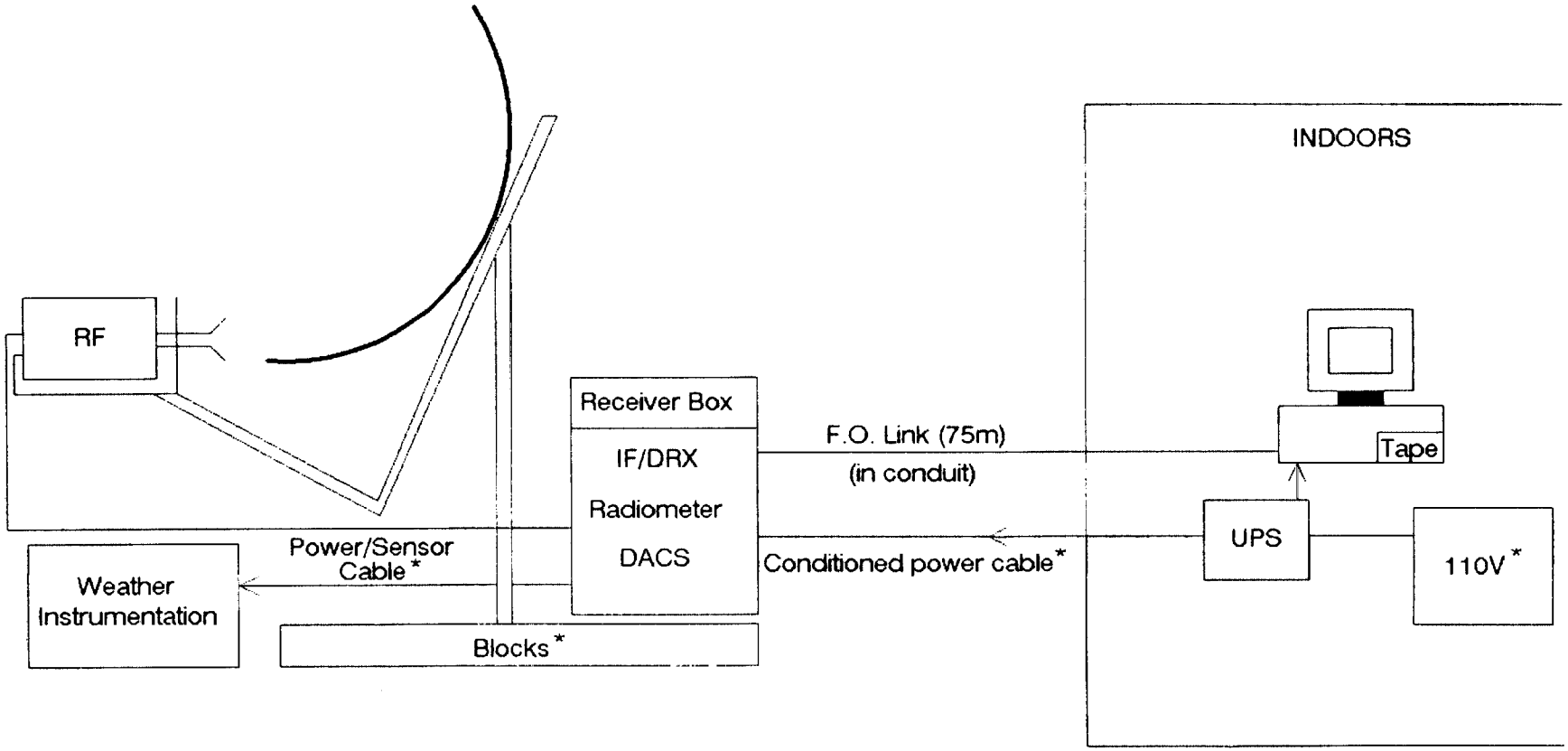
dev2.drw
06/07/93

APT FUNCTIONAL SUBSYSTEMS



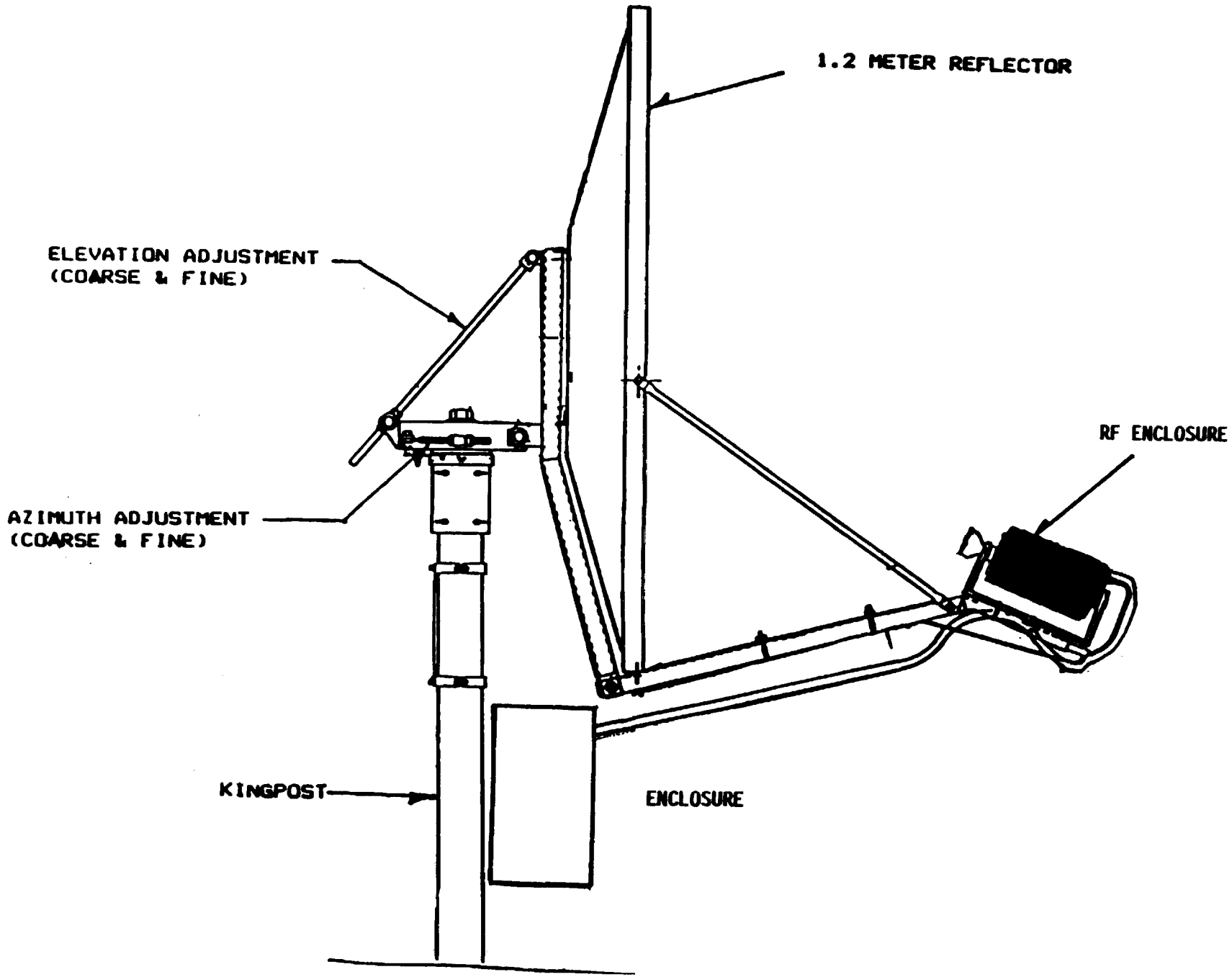
func1.drw
04/09/93

ACTS Propagation Terminal Physical Diagram

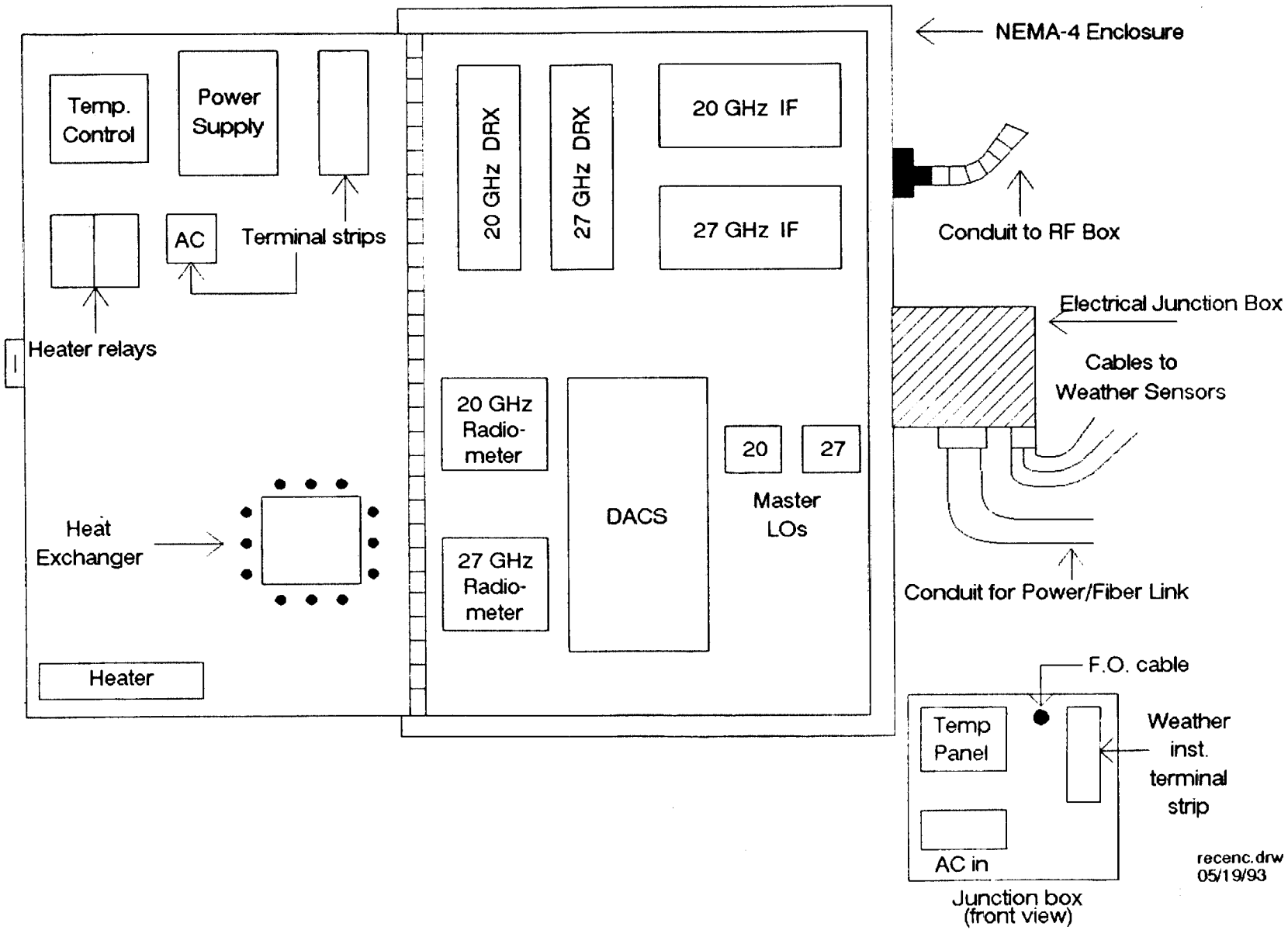


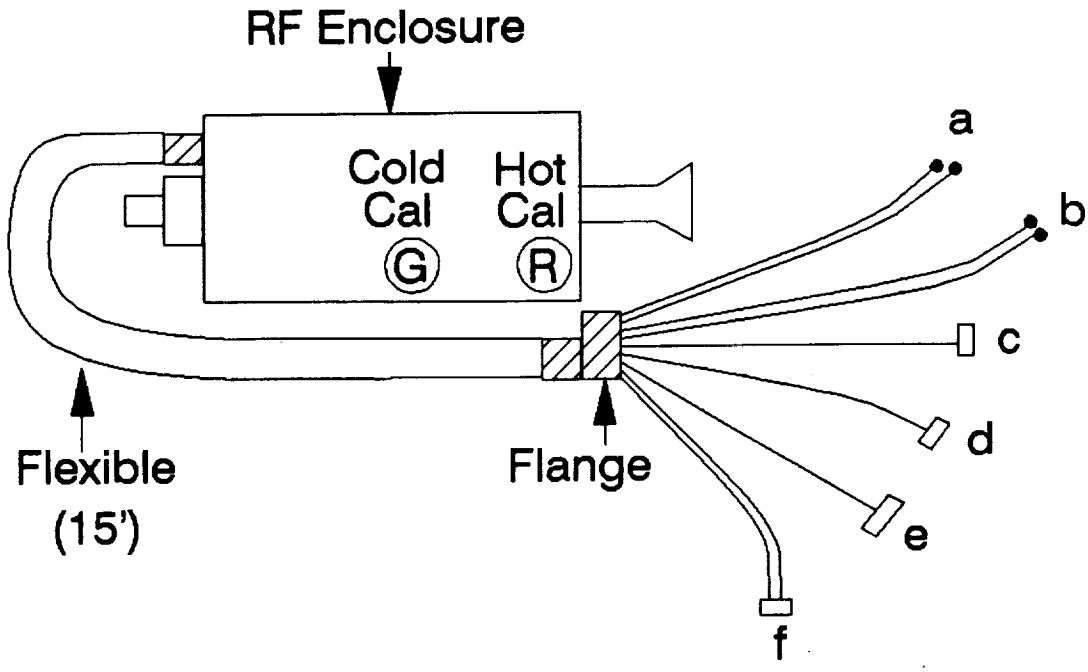
* User supplied

physical.drw
06/09/92


1.2 METER REFLECTOR
ELEVATION ADJUSTMENT
(COARSE & FINE)
RF ENCLOSURE
AZIMUTH ADJUSTMENT
(COARSE & FINE)
KINGPOST
ENCLOSURE

ACTS Receiver Enclosure Layout





a) LO drive (20, 27) RG58 w/SMA-male.

b) 70 MHz IF (20, 27) Microflex 150 w/SMA-male.

c) RF power cable, 3 conductor twisted w/4 pin molex.

d) RF control cable w/DB25 male connector.

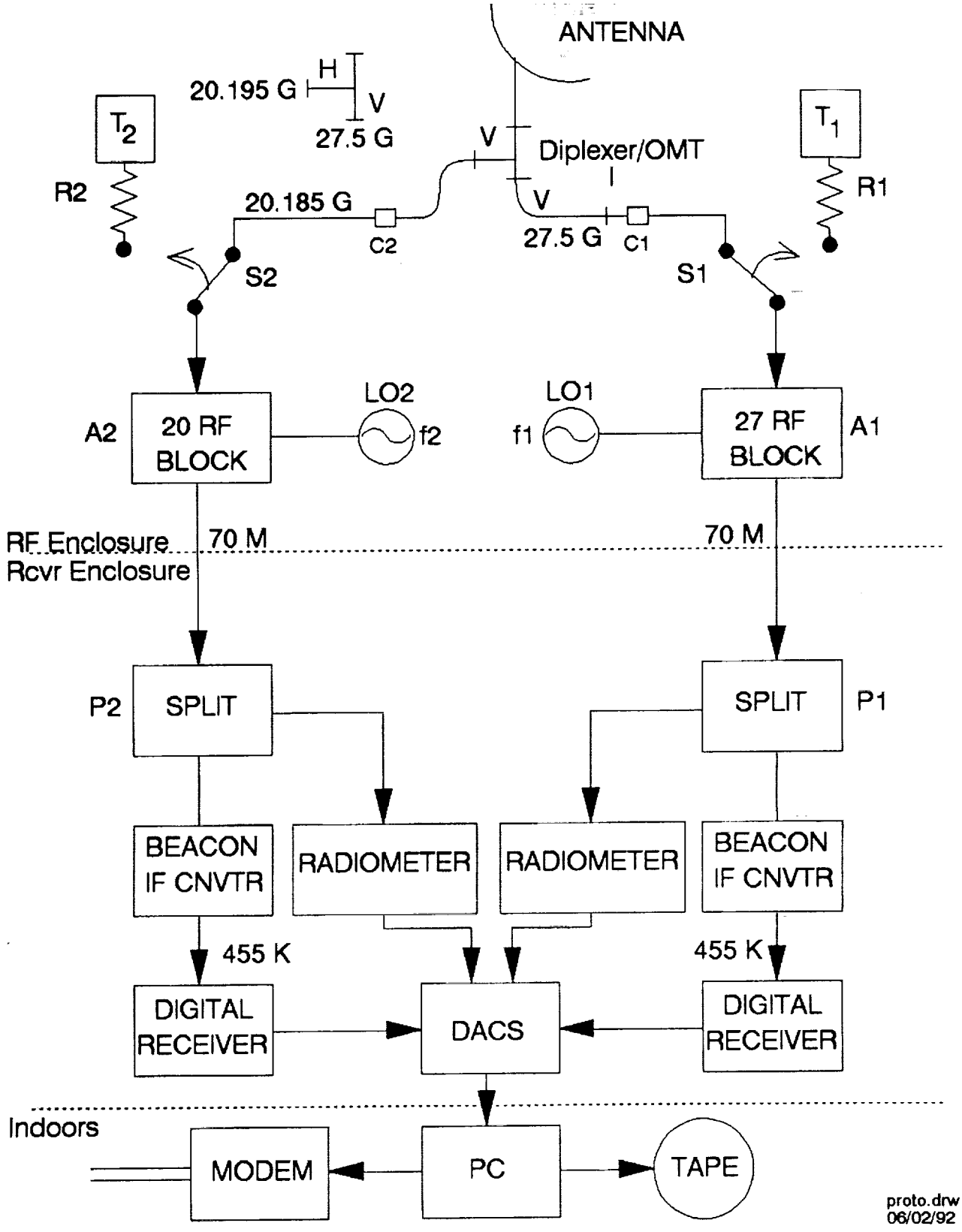
e) RF control cable w/DB9 male connector.

f) RF temperature control cable assy (two cables) w/DB-15 profile hybrid connector.

conduit.drw
06/01/93

Figure 3.1-2. Conduit/Cable assembly between RF and Receiver Enclosures.

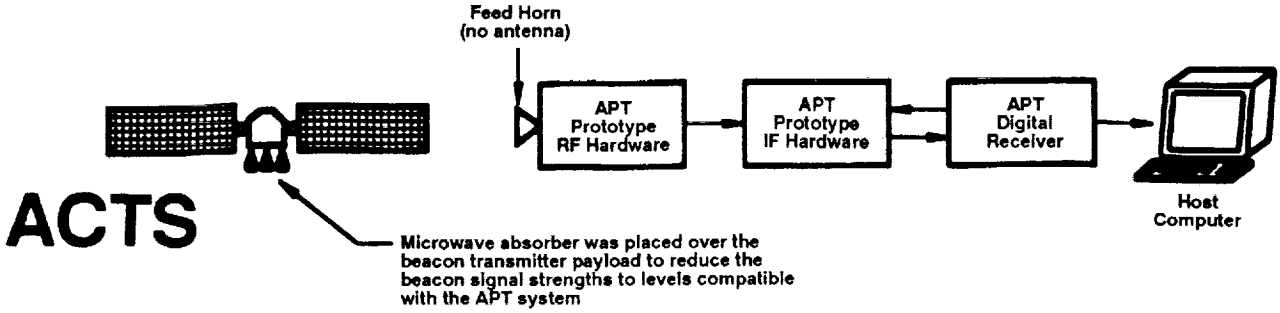
ACTS PROPAGATION TERMINAL

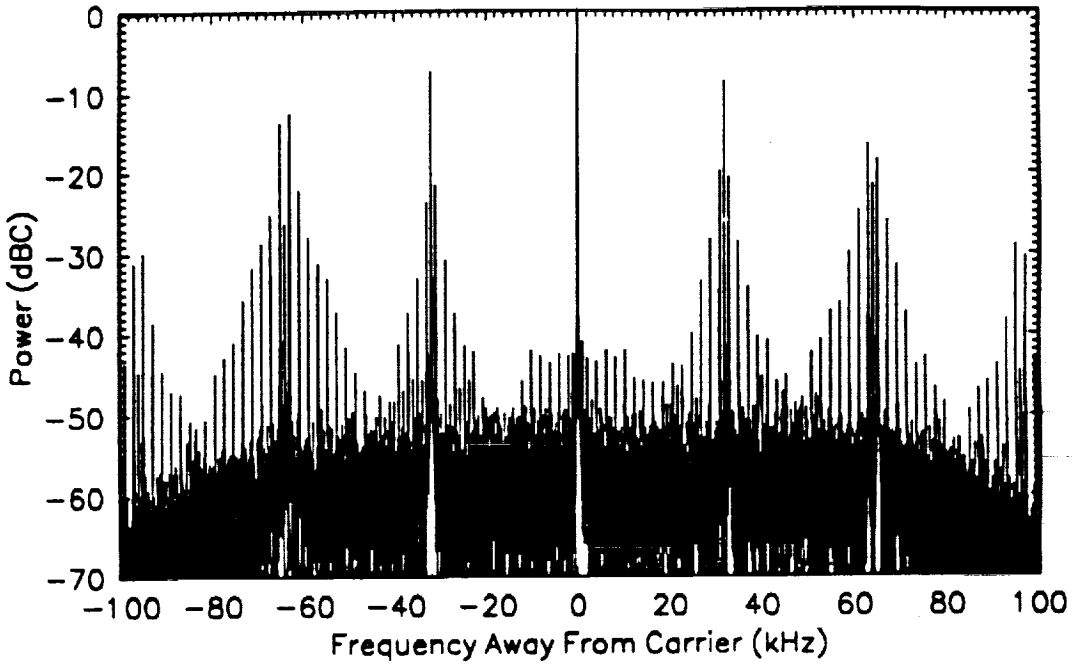


TEST RESULTS

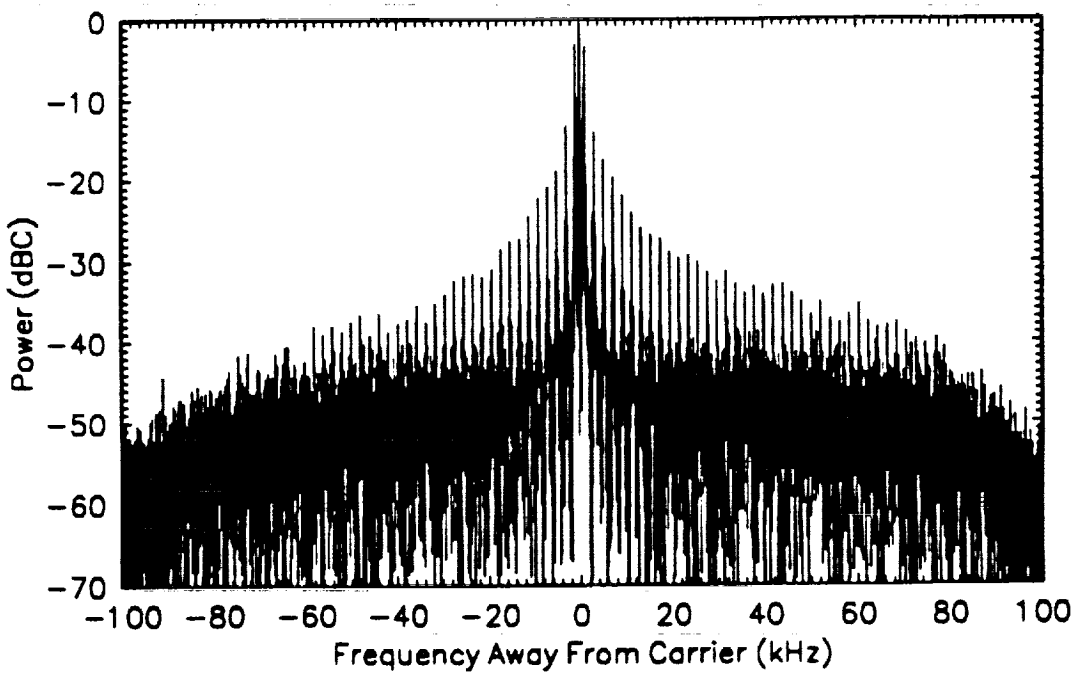
- IF/Digital Receiver (Prototype)
  - Signal injection - linear response
  - Olympus 20 GHz beacon during a rain storm -
    - Reproduced Olympus analog receiver exactly
- Full Prototype system
  - ACTS spacecraft in NJ - acquired and measured spectra
- Beacon tests - Production
  - RF signal injection
  - Stable with time tests
- Radiometer tests - Production
  - Hot/Cold calibrations
  - Stable with time tests
  - Rain Measurements with system outside

a:test1.drw
06/10/93



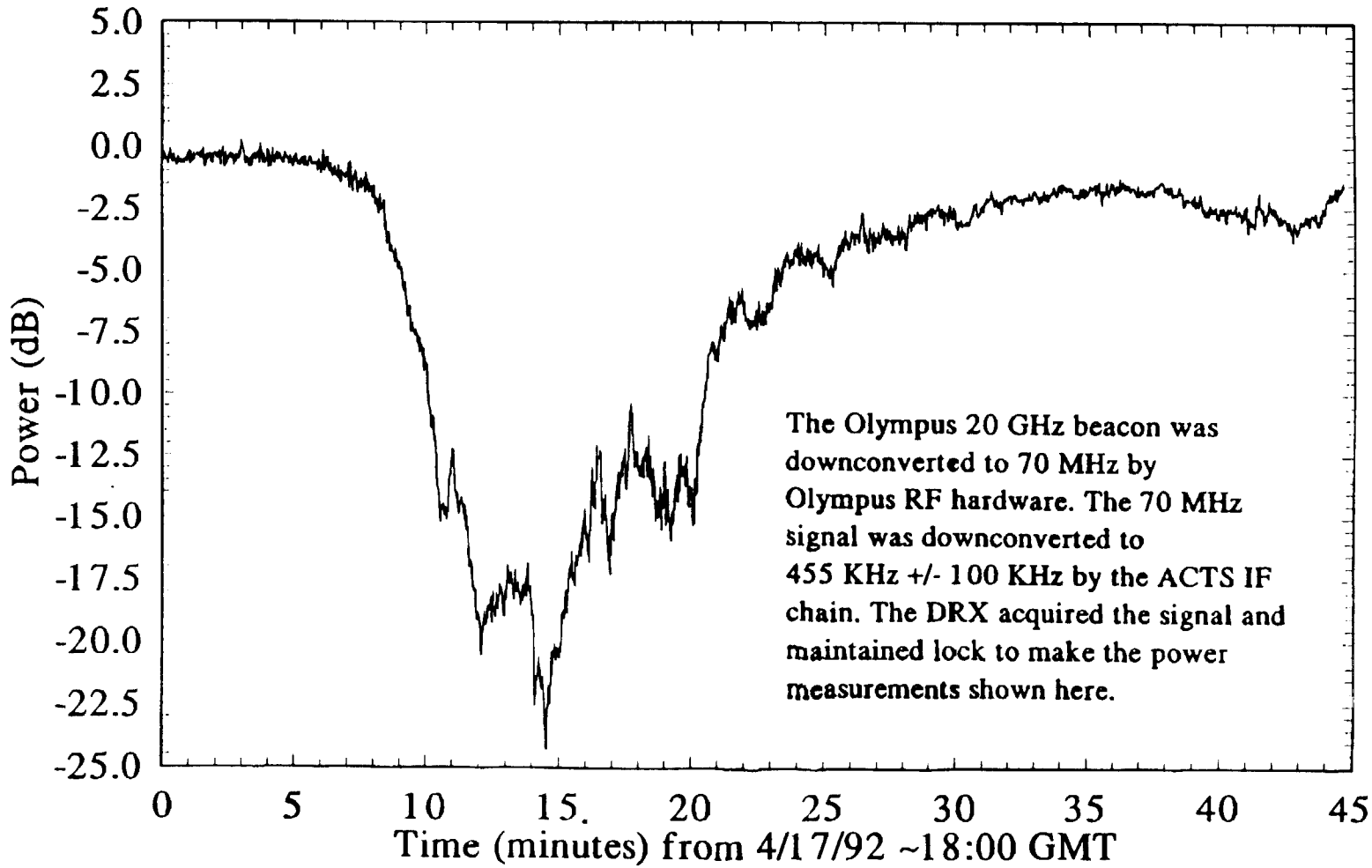


32768-point spectrum of the ACTS 20 GHz beacon in *Digital PCM Telemetry Mode*.

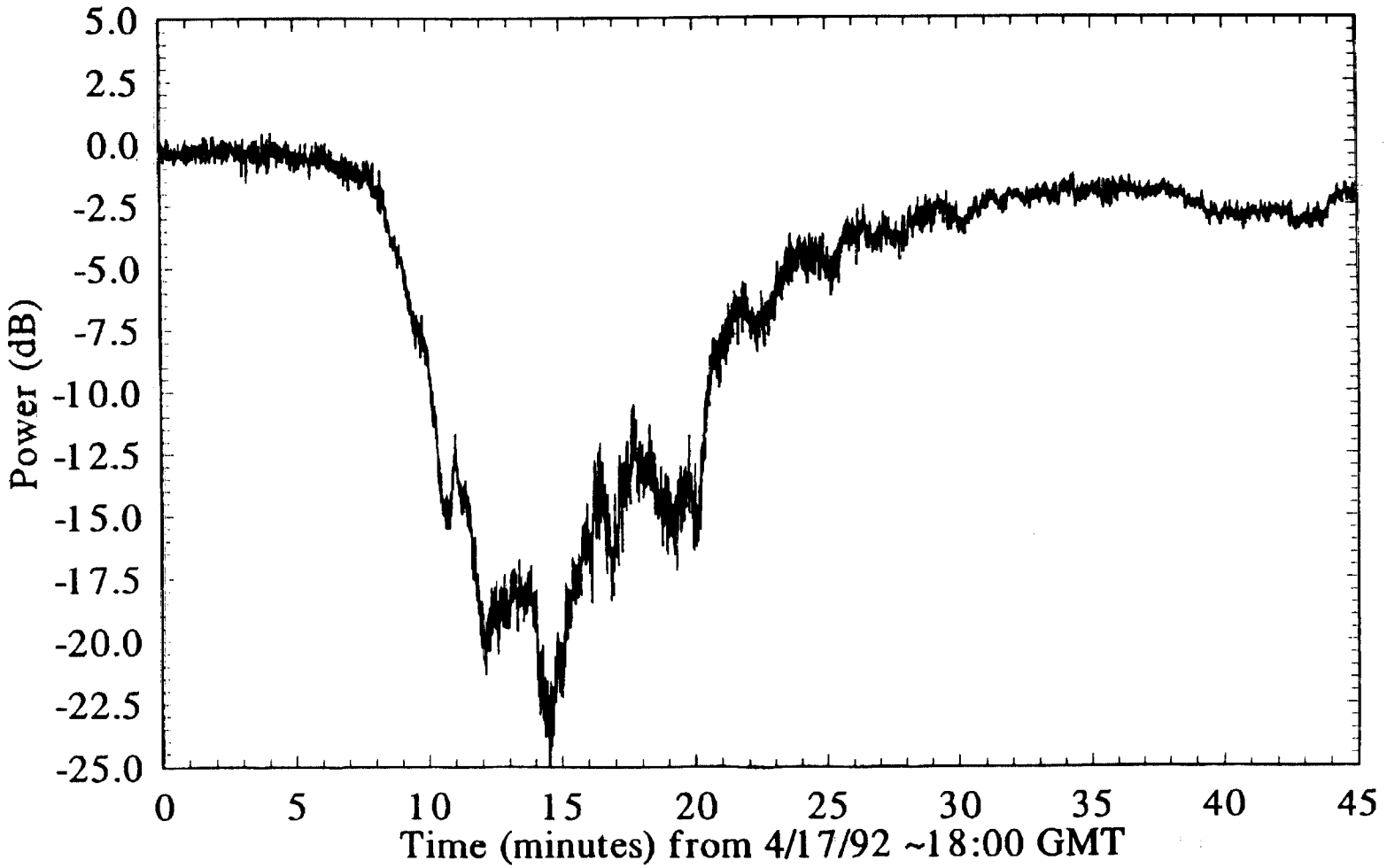


32768-point spectrum of the ACTS 20 GHz beacon in *PCM Direct Mode*.

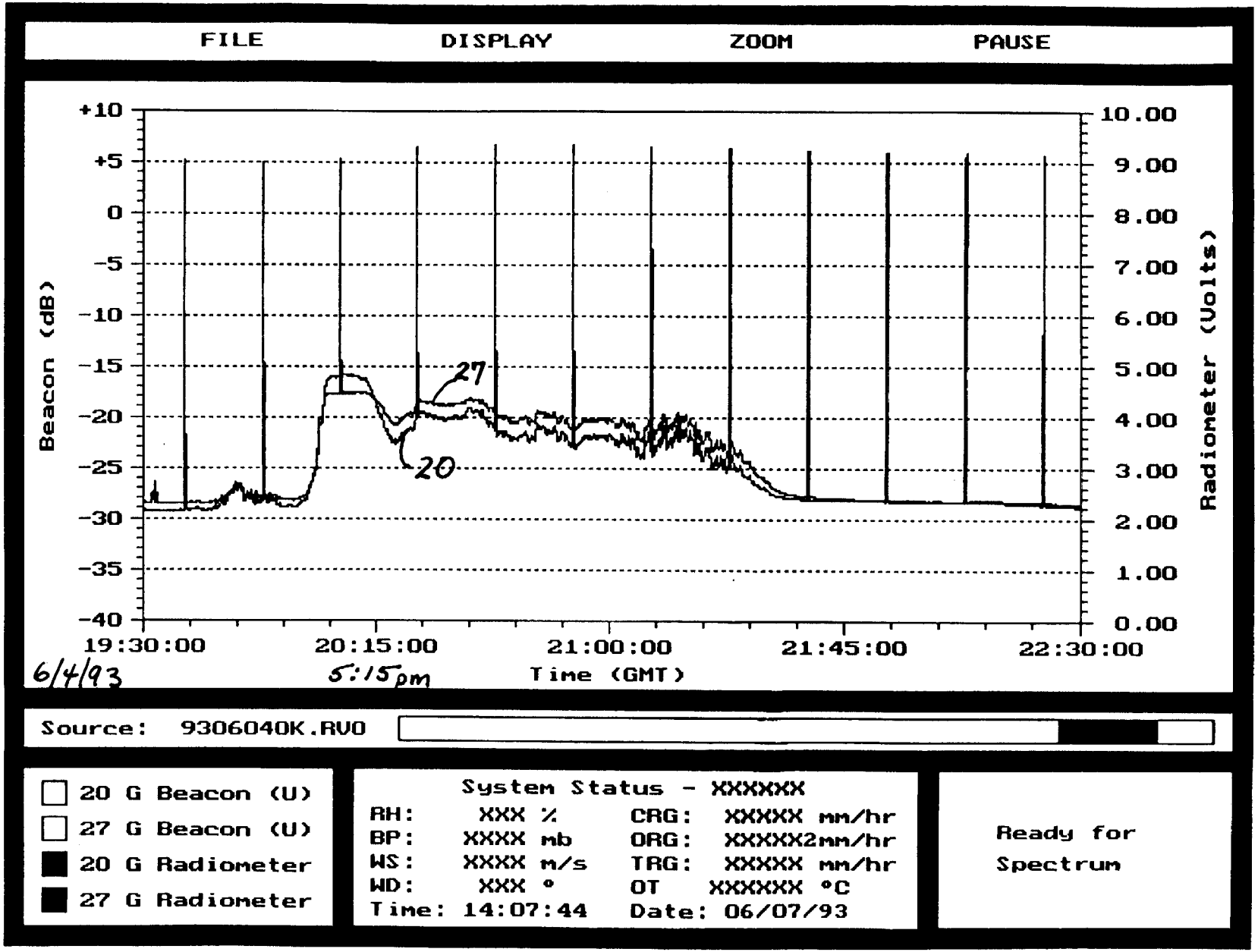
ACTS Digital Receiver Power Measurement



OLYMPUS Analog Receiver Power Measurement



Radiometer Operation during a Thunderstorm



APT SHIPPING CARTONS

- Units shipped from Blacksburg, Virginia

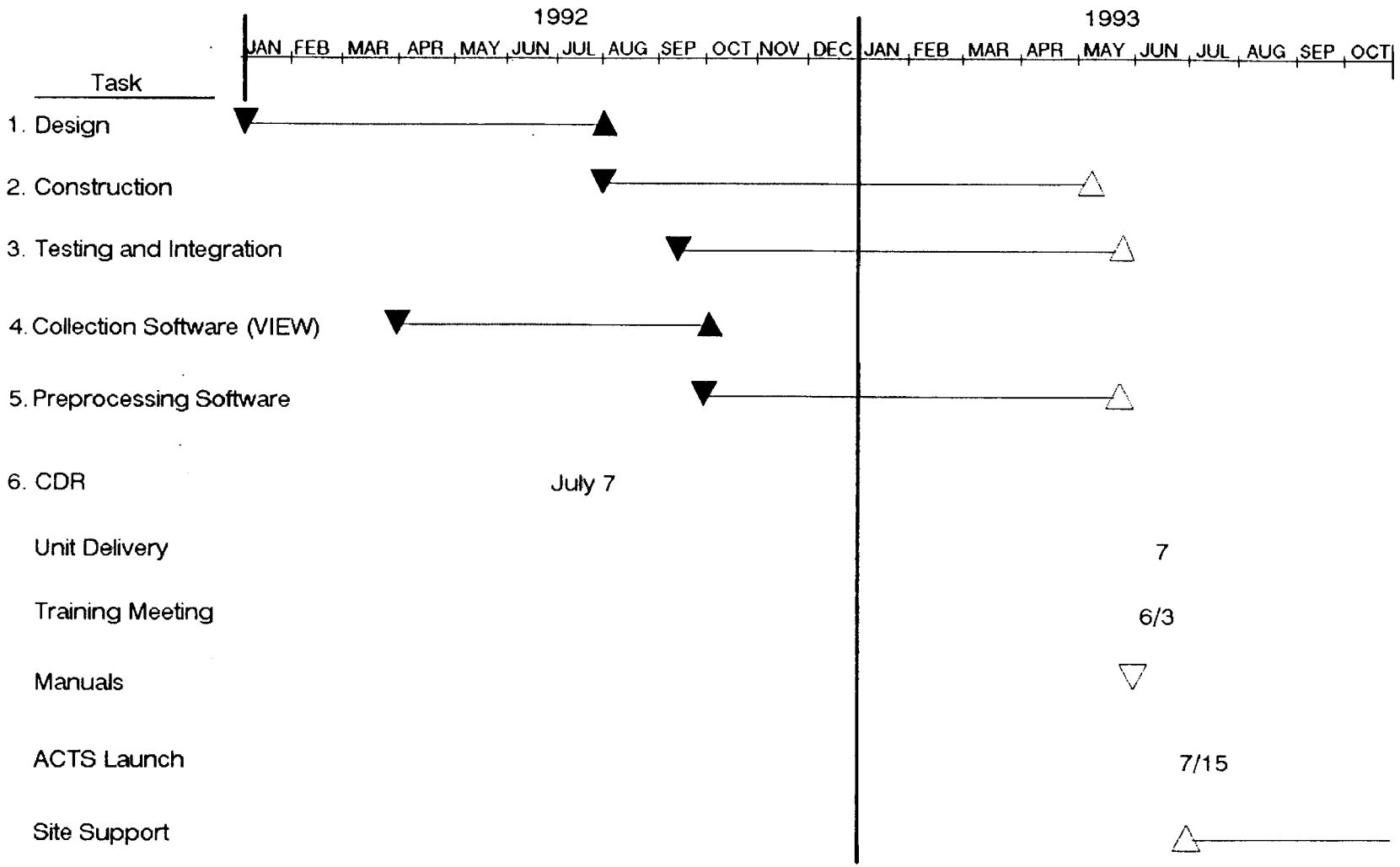
Box No.	Description
1	Receiver Enclosure
2	RF Enclosure
3	Computer CPU
4	Computer Monitor
5	Miscellaneous

- Units shipped directly from manufacturers

  Antenna pedestal
  Antenna
  Wind gauge
  Capacitive rain gauge
  Uninterruptable power supply

a:units.drw
06/09/93

ACTS Propagation Terminal Production Schedule



sched.drw
05/14/93

TERMINAL STATUS SUMMARY

Hardware

- LNB problems solved by adding an isolator to 20 G channels
- Shipping schedule
  - Week of 6/7: 2 6/14: 2 6/21: 2 6/28: 1
- Shipping order
  - NM, FL, OK, AK, CO, MD, BC

Software

- DACS code - complete
- ACTSVIEW - complete
- 20 Hz-rate data development in progress

Documentation

- Training Session - Held on 6/3 with full site representation
- Hardware Manuals - distributed
- ACTSVIEW Code and Manual - distributed
- Preprocessing Code and Manual - nearly complete

a:term1.drw
06/09/93

ACTS Propagation Site Support at Virginia Tech

Hardware

- Maintain operational spares for a subassembly swap
- Maintain documentation including calibration procedures
- Send updates to experimenters

Software

- Maintain DRX software, DACS software, VIEW, Preprocessing
- Send software updates to experimenters by E-mail

Site Visits

- As necessary for troubleshooting/calibration

Data Collection/Reduction

- Advise experimenters of S/C changes
- Process data in same fashion as experimenters

site1.drw
06/07/93